Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

What is claimed is:

1. (Currently amended) An apparatus for polishing diamond surfaces by generating atomic oxygen ions in plasma form comprising:

a body having a chamber formed therein, the body having an open end and a power-source end, with the open end of the body forming a plasma source exit having an exit plane;

an array of confinement magnets encircling the body, whereby the body and the array of confinement magnets form a plasma generation reaction chamber;

an electron source filament connected to an AC power source located outside the body, said electron source filament being inserted into the plasma generation reaction chamber;

a gas port inserted through the power-source end of the body and into the plasma generation reaction chamber;

an oxygen source for introducing oxygen gas into the plasma generation reaction chamber in the body through the gas port;

a DC power source located outside the body, and connected between the electron source filament and the body;

an oxygen plasma producing element for producing oxygen plasma by heating the filament to thermionic temperatures using the AC power source, causing primary electrons to be emitted therefrom, and to collide with the oxygen gas, producing oxygen plasma including a portion of primary electrons; and

an array of filtration magnets positioned near the plasma source exit, and

parallel to the plasma source exit plane, said array of filtration magnets separating the reaction chamber into an upstream region containing the confinement magnets and a downstream region, and wherein the filtration magnets pass the oxygen plasma to the plasma source exit and prevent the primary electrons from entering the downstream region of the reaction chamber.

2. (New) An apparatus for polishing diamond surfaces as set forth in Claim 1, further comprising a container for placing at least one diamond sample, wherein said at least one diamond sample has a surface, and wherein the container is positioned in the path of the oxygen plasma exiting through the plasma source exit, and the said at least one diamond remains in the path of the oxygen plasma until the surface of the diamond sample has optical quality smoothness.

3. (Original, previously Claim 2) An apparatus for polishing diamond surfaces by generating atomic oxygen ions in plasma form as set forth in Claim 2, wherein the electron source filament is formed of a material selected from the group consisting of tungsten, tantalum, and iridium.

4. (Original, previously Claim 3) An apparatus for polishing diamond surfaces by generating atomic oxygen ions in plasma form as set forth in Claim 2, wherein the body is formed of low carbon steel.

5. (Previously presented, previously Claim 4) An apparatus for polishing diamond surfaces as set forth in Claim 2, wherein the plasma is comprised of at least 60% atomic oxygen ions.

6. (Original, previously Claim 5) An apparatus for polishing diamond surfaces as set forth in Claim 2, wherein a discharge voltage applied between the DC power source and the electron source filament is between 50 and 150 volts.

7. (Original, previously Claim 6) An apparatus for polishing diamond surfaces as set forth in Claim 2, wherein a pressure of oxygen gas introduced into the plasma generation reaction chamber is between 6.0×10^{-5} and 1.2×10^{-4} Torr.

8. (Currently Amended, previously Claim 7) An apparatus for polishing diamond surfaces by generating atomic oxygen ions in plasma form comprising

a magnetic cylinder having a cylindrical chamber formed therein and an open end and a power-source end, with the open end of the cylinder forming a plasma source exit having an exit plane;

a non-magnetic cooling jacket formed in a substantially annular and cylindrical shape positioned within the cylindrical chamber of the magnetic cylinder;

a substantially annular and cylindrical array of confinement magnets encased within said non-magnetic cooling jacket, whereby the magnetic cylinder and the array of confinement magnets form a plasma generation reaction chamber;

an electron source filament connected to an AC power source located outside magnetic cylinder, said electron source filament being inserted through power-source end of the magnetic cylinder and into the plasma generation reaction chamber;

a gas port inserted through the power-source end of the magnetic cylinder and into the plasma generation reaction chamber;

an oxygen source for introducing oxygen gas into the plasma generation reaction chamber in the magnetic cylinder through the gas port;

a DC power source located outside the magnetic cylinder, and connected between the electron source filament and the magnetic cylinder;

an oxygen plasma producing element for producing oxygen plasma by heating the filament to thermionic temperatures using the AC power source, causing primary electrons to be emitted therefrom, and to collide with the oxygen gas, producing oxygen plasma including a portion of primary electrons; and

an array of filtration magnets positioned near the plasma source exit, and parallel to the plasma source exit plane, said array of filtration magnets separating the reaction chamber into an upstream region containing the confinement magnets and a downstream region, and wherein the filtration magnets pass the oxygen plasma to the plasma source exit and prevent the primary electrons from entering the downstream region of the reaction chamber.

9. (New) An apparatus for polishing diamond surfaces as set forth in Claim 8, further comprising a container for placing at least one diamond sample, wherein said at least one diamond sample has a surface, and wherein the container is positioned in the path of the oxygen plasma exiting through the plasma source exit, and the said at least one diamond remains in the path of the oxygen plasma until the surface of the diamond sample has optical quality smoothness.

10. (Original, previously Claim 8) An apparatus for polishing diamond surfaces by generating atomic oxygen ions in plasma form as set forth in Claim 9, wherein the electron source filament is formed of a material selected from the group consisting of tungsten, tantalum, and iridium.

11. (Original, previously Claim 9) An apparatus for polishing diamond surfaces by generating atomic oxygen ions in plasma form as set forth in Claim 9, wherein the magnetic cylinder is formed of low carbon steel.

12. (Original, previously Claim 10) An apparatus for polishing diamond surfaces by generating atomic oxygen ions in plasma form as set forth in Claim 9, wherein the non-magnetic cooling jacket is formed of stainless steel.

13. (Original, previously Claim 11) An apparatus for polishing diamond surfaces by generating atomic oxygen ions in plasma form for polishing diamond surfaces as set forth in Claim 9, further comprising a cylindrical

molybdenum shield located between the non-magnetic cooling jacket and the plasma generation reaction chamber.

14. (Previously presented, previously Claim 12) An apparatus for polishing diamond surfaces as set forth in Claim 9, wherein the plasma is comprised of at least 60% atomic oxygen ions.

15. (Original, previously Claim 13) An apparatus for polishing diamond surfaces as set forth in Claim 9, wherein a discharge voltage applied between the DC power source and the electron source filament is between 50 and 150 volts.

16. (Original, previously Claim 14) An apparatus for polishing diamond surfaces as set forth in Claim 9, wherein a pressure of oxygen gas introduced into the plasma generation reaction chamber is between 6.0×10^{-5} and 1.2×10^{-4} Torr.